

Little Deer Creek Headwaters Watershed Management Plan

Howard County, Indiana

HUC #05120105050040

IDEM Contract No. ARN A305-3-669



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Prepared by the Howard County Soil
and Water Conservation District
in cooperation with stakeholders
of the Little Deer Creek Headwaters Watershed

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INTRODUCTION

Purpose

The purpose of this project is to investigate land use and water quality issues within the Little Deer Creek Headwaters watershed (Figure 1), identify potential water quality problems, and develop strategies for solving these problems.

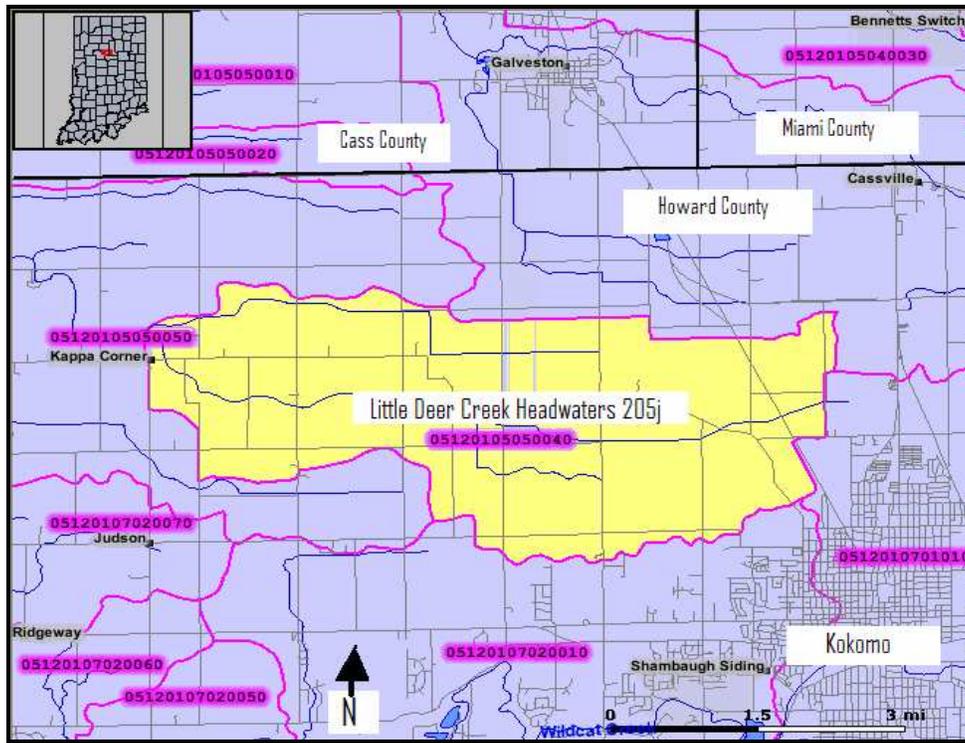


Figure 1. Location of Little Deer Creek Headwaters 205j Project (HUC #05120105050040) in Howard County, Indiana.

Project Origin

In 2001, the Howard County Soil and Water Conservation District (SWCD) identified the Little Deer Creek Headwaters watershed as an area for study of potential water quality problems. The area has high numbers of livestock, soil tests that reflect concentrated manure applications, and a large amount of cropland. The SWCD was concerned about nonpoint source pollution from these sources and the impact of the Little Deer Creek Headwaters on downstream water quality problems. Little Deer Creek drains to Deer Creek in Carroll County, which is listed by the Indiana Department of Environmental Management (IDEM) as an impaired waterbody (2004 *Integrated Water Quality Monitoring and Assessment Report*, IDEM).

Plan Development

The SWCD received a 205j watershed planning grant from the Indiana Department of Environmental Management (IDEM) and the U.S. Environmental Protection Agency (USEPA) in January, 2003. The SWCD board assumed the role of steering committee for the project. They were responsible for overall management of the project (hiring a watershed coordinator, budgeting, monitoring progress, assisting with contacts and meetings). The steering committee met each month.

In April 2003, the SWCD formed a stakeholder advisory committee. This committee had representation from farm operators, rural residents not on farms, and interested citizens, including the Wildcat Guardians, a local not-for-profit group dedicated to protecting Wildcat Creek. The role of the stakeholder committee was to help identify land use and water quality concerns in the project area. A series of meetings was planned to provide several opportunities for local citizens to voice concerns and learn more about the watershed. At the initial stakeholder meeting, participants agreed to a vision statement as follows: *To maintain a level of stewardship that allows waterways to be used for their intended purpose including drainage and human contact.*

The stakeholder committee met eight times over the course of the project. Meeting attendance averaged 10 to 12 citizens. At the first meeting, participants listed these concerns for the watershed:

- drainage
- ditch maintenance
- soil erosion
- development
- chemicals from farms and homes
- drinking water
- septic systems
- dumping
- education
- storm runoff from farms, homes and roads
- economics
- wildlife habitat

Some of these concerns were also expressed directly to the watershed coordinator and in written responses to a survey mailed to 294 residents of the project area (Appendix A). At each stakeholder meeting, a selected topic was discussed along with possible solutions to potential water quality problems. A list of meeting dates and topics is in Appendix B.

The following entities assisted in the development of this plan:

- Local citizens assisted with the land inventory of the watershed and attended meetings to develop the watershed management plan.
- The Natural Resources Conservation Service in Howard County provided information about land use.
- The Howard County Health Department assisted in coordinating surface water testing.

- The Indiana State Department of Health analyzed surface water samples.
- The Indiana-American Water Company, Inc., Kokomo, tested for Atrazine in surface water samples.
- Commonwealth Biomonitoring, Indianapolis, conducted the biological monitoring.
- The Indiana Department of Environmental Management provided grant funding, water quality information, land use data.
- Purdue University Extension provided Confined Animal Feed Operation information.
- The Indiana Department of Natural Resources provided information.

WATERSHED DESCRIPTION

The Little Deer Creek Headwaters watershed consists of 9,114 acres of land located in northwestern Howard County (Figure 1). The Little Deer Creek Headwaters watershed is one of the 14 digit hydrologic unit code (HUC#05120107020070) sub-watersheds that make up the larger Middle Wabash – Deer Creek watershed. Approximately 332 people live in this watershed. This watershed has 10.06 miles of open waterway. Federal and state law broadly defines designated uses of these waterways for aquatic life support, fishing, and primary contact recreation (swimming). The larger ditches are McKay Dredge, Harrison Harlan, Sarah Holipeter and Clay Union. All originally were natural, perennial streams but have been altered to improve agricultural drainage. All of the waterways in the watershed are considered legal drains and have a 75 foot drainage easement on either side.

The outlet stream for this watershed is McKay Dredge Ditch, which drains to the Little Deer Creek in Howard County. Little Deer Creek drains to the larger Deer Creek in Carroll County. The Deer Creek drains to the Wabash River southeast of Delphi, Indiana. The Deer Creek is on the IDEM 2004 303(d) List of Impaired Waterbodies due to the presence of polychlorinated biphenyls (PCBs) and mercury (Appendix C). There are Level 2 and 3 fish consumption advisories for selected fish species in the Deer Creek (Appendix D). There are no plans to conduct a Total Maximum Daily Load Study (TMDL) on the Little Deer Creek Headwaters.

Geology

The landscape of Howard County was shaped by several glaciations. Most recently, from about 10,000 to 15,000 years ago, the Wisconsin Glacier deposited parent material for soils in the Little Deer Creek Headwaters watershed. The ground was scoured and leveled as the glaciers retreated through the northern half of Indiana. Glacial till (ground up rock and soil) was deposited over the limestone bedrock of Howard County. The till deposited over western Howard County was loam-textured and of mixed origin. As the ice melted and receded, melt water formed creeks such as Little Deer Creek. Outwash (sand and gravel) was deposited along the streambeds. Wind blown silt (loess) covered all parts of the county.

Soils

Glaciation and loess deposits resulted in three major areas of soil formation: upland till plains (silt over glacial till), outwash terraces (sand and gravel along drainages), and bottom

lands (flood plains receiving alluvium eroded from upland areas). The Little Deer Creek Headwaters watershed is an average of 820 feet above sea level. The predominant landform is upland till plain, flat to gently rolling with slopes of 0 to 2%.

Most of the watershed soils (95%) are in the Fincastle-Brookston association (deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level, on uplands). Minor soils in terms of area are in the Crosby-Brookston association (deep, somewhat poorly drained and very poorly drained, medium-textured and moderately fine textured, nearly level and gently sloping, on uplands).

The Fincastle (silt loam) and Brookston (silty clay loam) soils have a seasonal high water table and slow permeability. On these soils, tile drainage is necessary for successful crop growth and on-site wastewater disposal (septic systems). Pondered water is common on upland soils after heavy rainfall.

None of the soils in the watershed are considered highly erodible according to maps provided by the Howard County Farm Service Agency. Brookston silty clay loam is the only soil considered a hydric soil; however, the majority of this soil no longer supports hydrophytic vegetation due to tile drainage.

Upland soils are moderately acidic, which is a limitation for agriculture typically overcome by adding lime and fertilizer.

Climate

Howard County has a temperate climate with an average temperature of 30⁰ F in the winter and 75⁰ F in the summer. Low-pressure and high-pressure fronts pass through the area frequently. Precipitation averages around 37 inches per year. Sixty percent of precipitation falls from April to September. An estimated one-third of the total precipitation enters surface waters and flows out of the county. Precipitation is adequate for crop growth, but there are periods with low rainfall in the summer that can cause mild drought conditions. Relative humidity in the region varies from 45% to 100%. Prevailing winds are from the southwest, except in the winter when winds come from the northwest. Severe thunderstorms and tornadoes have the potential to occur in the area and cause localized damage.

Land Use

The original local landscape was a mixture of wet, swampy areas and dense stands of hardwood trees. The federal government purchased the area from the Miami Indians and organized Richardville County in 1844. The name was changed to Howard County in 1846. Early settlers used the major creeks to transport goods. Farming spread slowly across the area as trees were cleared and wetlands were drained. Industry expanded rapidly in Howard County when natural gas was discovered in 1886. Many factories located in Kokomo to take advantage of the inexpensive energy source.

Most (98%) of the Little Deer Creek Headwaters watershed is used for agriculture. Less than 1% of the area has an “urban” use (residences, churches, schools). The remaining 4% of the land is grassland, forest, wetland, and open water. All of the land in the

watershed is privately owned. The watershed is zoned as an area of minimal flooding (Kokomo-Howard County Plan Commission). Minimum lot size for development was recently increased from 20,000 to 30,000 square feet. Table 1 shows land use data for the Little Deer Creek Headwaters watershed.

| Table 1. Land Use Data for Little Deer Creek Headwaters Watershed (GAP Data from IDEM, 1992-93). | | |
|--|--------------|----------------------|
| Land Use | Area (acres) | Percent of Watershed |
| Developed: Agricultural, Pasture/Grassland | 135.35 | 1.49 |
| Developed: Agricultural, Row Crop | 8,760.88 | 96.12 |
| Developed: Agricultural, Wet Areas | 13.05 | 0.14 |
| Developed: High Density Urban | 18.79 | 0.21 |
| Developed: Low Density Urban | 24.98 | 0.27 |
| Palustrine: Forest, Deciduous | 77.98 | 0.86 |
| Palustrine: Herbaceous, Deciduous | 35.80 | 0.39 |
| Palustrine: Shrubland, Deciduous | 14.80 | 0.16 |
| Terrestrial: Forest, Deciduous | 19.38 | 0.21 |
| Terrestrial: Shrubland, Deciduous | 7.90 | 0.09 |
| Water | 5.35 | 0.06 |
| Total | 9,114.25 | 100% |

BASELINE ASSESSMENT

The baseline assessment includes results from a windshield survey and information from records and staff of the Howard County SWCD, IDEM, and IDNR. The watershed coordinator organized the information to provide a picture of current land use and water quality within the Little Deer Creek Headwaters project.

Land Use

Windshield Survey

A windshield survey of current conditions in the watershed was conducted using volunteers in the summer of 2003. The method used was adapted from the “Watershed Inventory Workbook for Indiana” (Frankenberger et. al., 2002). Volunteers were given a driving route and a series of worksheets to record observations about streams, residential and urban areas (homes, construction sites, impervious areas, recreational facilities, unrecorded discharge pipes), pasture, cropland, and forested land.

Residential and Urban Areas

There are small clusters of homes throughout the watershed. All of these homes use on-site wastewater disposal and private drinking water wells. The Northwestern School Corporation is the only regulated point pollution source (NPDES permitted) in the watershed. Playing fields at the school are the only public recreational facility in the watershed.

The amount of impervious area in the watershed is small, consisting of roads, residential, commercial and farm buildings, driveways and parking lots. Stormwater control for this area consists of the drainage ditches and streams in the watershed. There are also several small residential and farm ponds. Some new home construction was observed during the windshield survey.

Agriculture

Agriculture is primarily row crop production of corn and soybeans. Small grains and hay are minor crops. Tillage practices range from conventional (moldboard plow) to no-till. Conventional tillage has decreased in Howard County over the last ten years for both corn and soybeans (Conservation Technology Information Center, 2002). Many farmers are using forms of reduced tillage, including no-till, mulch-tillage and ridge-tillage. No tillage for soybeans has been increasing over the last ten years in Howard County. No-till was used on less than 1 percent of soybeans in 1990. In 2000, no-till was used on 39 percent of soybeans in Howard County (Conservation Technology Information Center, 2002). The acreage of corn in conservation tillage has also increased, but this tillage is reduced tillage, not no-till. According to some farmers who have attended stakeholder meetings and a local crop consultant, certain crop management issues, such as planting time, soil temperature and weed pressure, are compatible with no-till soybeans but not corn. Some of the increase in no-till is likely happening within the Little Deer Creek Headwaters watershed; however, the windshield survey did not determine the current level of conservation tillage in the watershed.

A record search of the Farm Service Agency maps in Howard County showed that six different landowners in the watershed are currently involved with federal conservation programs. The following practices are currently under federal contract: 34.1 acres of filter strips on 12 tracts of land, and 1.2 acres of grassed waterways on 2 tracts of land.

The livestock total in the Little Deer Creek Headwaters watershed is approximately 9,800 animal units, mostly swine in confinement. There are small numbers of other pastured livestock.

An animal unit is equivalent to 1,000 pounds of animal mass, which may vary from less than one large animal to several smaller or young animals. Confinement operations usually store waste in pits under the building. Pits are pumped out and the waste is spread on available cropland. Manure is usually spread by injection under the soil surface, which is presumed preferable to surface spreading for several reasons (less runoff potential, greater capture of nutrients, less odor). The crop consultant, farmers, and the NRCS staff note that levels of phosphorus are extremely high in some fields close to hog barns indicating that these fields have historically received most of the animal waste, a common situation in Indiana. Six swine operations are permitted Confined Animal Feeding Operations (CAFOs) (Appendix E). All but one CAFO are within a half mile of a stream. There are other swine producers close to this watershed, and some of the manure produced at these facilities may be spread on cropland within the watershed.

Forested Land

The hardwood forests that originally covered this area have been reduced to scattered, small wooded parcels. There are many privately owned areas of woodland in the Little Deer Creek Headwaters watershed. These stands range in size from very small to about 10 acres. As a result of this fragmentation, a significant amount of wildlife habitat has been lost. During the windshield survey, participants noted that many of these forested areas had a sparse amount of small trees and underbrush, indicating they have been used for pasture.

Natural Areas and Endangered Species

The DNR maintains a list of endangered, threatened, and rare species for the state. Listings for Howard County are in Appendix F. It is possible that some listings may apply to the Little Deer Creek Headwaters watershed but detailed studies have not been done to document specific locations of endangered, threatened, or rare species within the watershed. The DNR Division of Nature Preserves has an unconfirmed record of a bobcat sited in 1988.

Stream Observations

Almost all local streams have been altered in some way to improve drainage. This includes straightening, filling, and dredging. There are some areas with “natural” vegetation including trees and shrubs. Some stream banks are quite steep as a result of repeated dredging. The windshield surveyors recorded grassed banks with a few small trees but noted some erosion in adjacent cropland. At the time of the windshield survey (summer 2003), stream flow was typically low, estimated at less than 10 cubic feet per second. All streams have a silt bottom but were running clear at this time. Some streams have a vegetation buffer, but in other situations the crop field extends all the way to the edge of the stream bank.

Water Quality

Existing Data

No previous surface water quality studies have been conducted specifically for the Little Deer Creek Headwaters watershed. Downstream from this watershed, IDEM studies show PCB contamination in both the sediment and fish tissue of Deer Creek in Carroll County. Deer Creek is fed by the Little Deer Creek Headwaters watershed; however, a substantial portion of the Deer Creek watershed is in Cass and Miami Counties and includes several small towns, whereas the Little Deer Creek Headwaters watershed is 96 percent cropland. Level 2 and 3 fish consumption advisories are in place for Deer Creek in Carroll County.

An IDEM study of pesticides in surface waters of the Upper Wabash River Basin, including the Little Deer Creek Headwaters watershed, was published in 2001 (McDuffee, R. 2001. *An Assessment of Pesticide Concentrations in the Upper Wabash River Basin*. IDEM, Office of Water Quality, Assessment Branch, Surveys Section, Indianapolis, IN. IDEM 032/02/024/2001). The closest downstream sampling point to the Little Deer Creek Headwaters watershed outlet is on Deer Creek at Delphi in Carroll County, several miles downstream of the project area. Water samples from this site contained concentrations of the commonly used herbicide Atrazine that were above drinking water standards in 2 out of 16 samples. The two samples were collected following elevated stream discharge in mid-June, the period of the year when agricultural herbicides are most commonly applied. Interestingly, one month later, the highest discharge recorded during the study at this sampling site yielded a level of Atrazine that was well below the drinking water standard. This reflects the fact that Atrazine is fairly soluble and degrades quickly. Atrazine moves off site primarily with storm runoff that occurs soon after chemical application. Later storms move less of this chemical.

In the early 1990s, the Indiana Farm Bureau coordinated a county-based, volunteer well water testing program. Samples were tested for nitrate, acetanilide, and Atrazine. In Howard County, 74 well samples were tested and none contained concentrations above drinking water standards (Indiana Farm Bureau, 1994. Well Testing Program).

Surface Water Monitoring

A surface water quality monitoring program was approved for the Little Deer Creek Headwaters watershed 205j project. The program followed procedures according to the Quality Assurance Project Plan (QAPP) developed for this project. The QAPP is on file with the Howard County SWCD.

The monitoring design was to conduct two rounds of grab sampling in 2003: spring sampling to represent high flow conditions followed by fall sampling to represent low flow conditions. The spring sampling took place on May 5, within 24 hours of at least 0.5 inches of rainfall. The fall sampling took place on October 22, prior to which no significant rainfall had occurred. Sample locations are shown in Figure 2. Latitude and longitude coordinates for these sites are in Appendix G. These were selected for the watershed outlet and bridge access to perennial feeder streams.

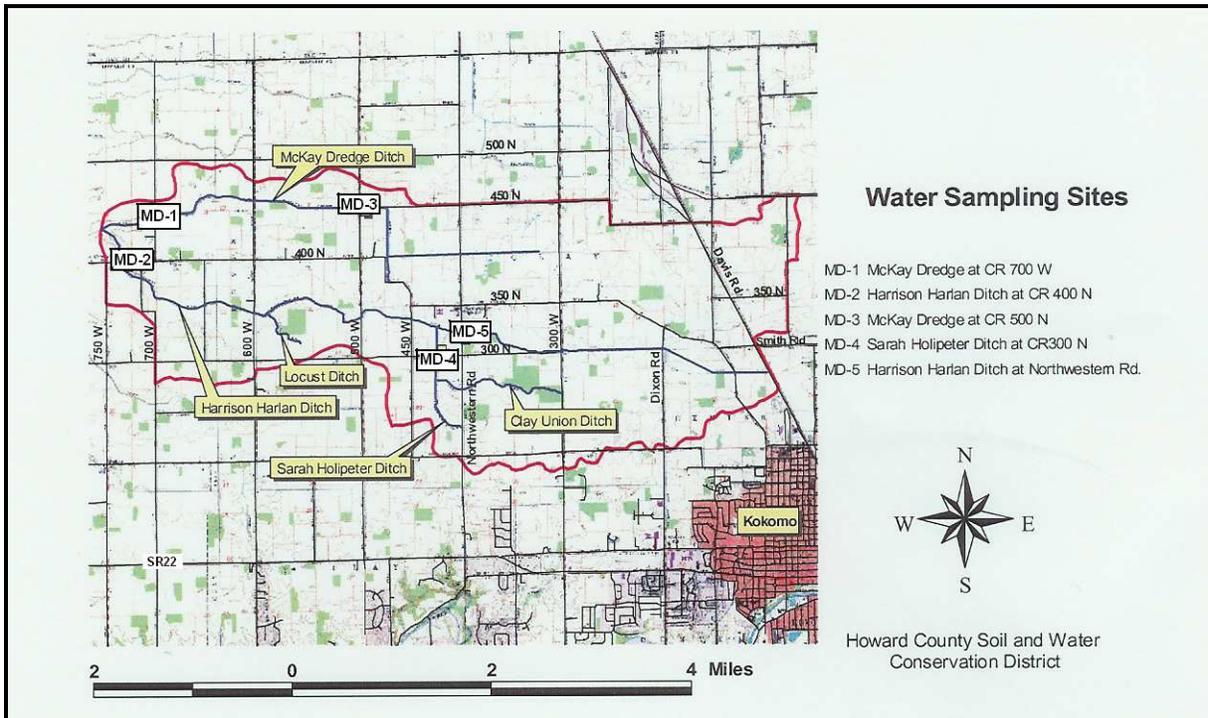


Figure 2. Water sampling locations in the Little Deer Creek Headwaters watershed.

Stream discharge was calculated manually in the field by observing stream width, depth, and rate of flow at three locations approximately 20 feet apart. Water quality analysis was conducted in the field using a Hach Surface Waters testing kit. The variables tested were: water temperature, pH, and dissolved oxygen. Turbidity was determined by using a turbidity tube. The remaining water quality variables were analyzed in the laboratory by two cooperators: the Indiana State Department of Health Environmental Laboratory in Indianapolis (ammonia, total Kjeldahl nitrogen, nitrate+nitrite, total phosphorus, E. coliform bacteria, and conductivity) and the Indiana-American Water Company office in Kokomo, Indiana (Atrazine). Results of the water analysis are in Table 2.

The water testing results clearly show that elevated stream discharge after a spring rain carries higher pollutant loads than low stream flow on a typical fall day. This is true for all nonpoint pollutants of concern in this watershed: sediment, ammonia, nitrogen, phosphorus, Atrazine, and E. coliform bacteria. When the concentration of a pollutant exceeds a water quality standard, the standard has been violated. Spring nitrate-nitrogen and Atrazine levels are above drinking water standards. Atrazine is below the surface water standard for incidental ingestion of non-drinking water. E. coli bacteria levels are very high in the spring, well above the water quality standard for primary contact recreation (swimming). With one exception, all of these variables in the fall water samples are below the standards. The exception is a fall water sample with E. coli at numbers still above the standard at sampling site MD4.

Table 2. Results of Water Analysis in the Little Deer Headwaters Watershed.

Spring sampling: 5/9/03 (within 12 hours of 0.5" rainfall / sunny, humid, air temp. 78 F / majority of crop planting complete)

Fall sampling: 10/22/03 (no recent rainfall / sunny, partly cloudy / crop harvest underway)

| SITE | TIME | | WATER TEMP. C(F) | | pH | | TURBIDITY (NTUs) | | DISCHARGE (cfs) | |
|-------|----------|----------|------------------|-----------|--------|------|------------------|------|-----------------|------|
| | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall |
| MD 1 | 12:10 PM | 9:45 AM | 13.89(57) | 12.22(54) | 7.7 | 8.3 | 250 | <10 | 45.6 | 5.62 |
| MD 2 | 11:30 AM | 10:25 AM | 14.44(58) | 11.11(52) | 7.6 | 8.2 | 175 | <10 | 87.5 | 4.22 |
| MD 3A | 11:05 AM | 11:10 AM | 13.89(57) | 11.11(52) | 7.6 | 8.1 | 150 | <10 | 45 | 3.29 |
| MD 3B | * | 11:10 AM | * | 11.11(52) | * | 8.1 | * | <10 | * | 3.29 |
| MD 4 | 10:25 AM | 11:40 AM | 13.89(57) | 12.22(54) | 7.5 | 8.2 | 225 | <10 | 37.7 | 1.6 |
| MD 5 | 9:35 AM | 12:10 PM | 13.33(56) | 12.22(54) | 7.6 | 8.5 | 125 | <10 | 70 | 2.78 |

| SITE | DISSOLVED OXYGEN (mg/L) | | AMMONIA (mg/L) | | TKN (mg/L) | | NITRATE+NITRITE (mg/L) | | TOTAL PHOSPHORUS (mg/L) | |
|-------|-------------------------|------|----------------|------|------------|------|------------------------|------|-------------------------|-------|
| | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall |
| MD 1 | 7 | 6 | 0.1 | <0.1 | 1.6 | 0.6 | 16 | 7.2 | 0.34 | 0.04 |
| MD 2 | 8 | 7 | 0.2 | <0.1 | 2.4 | 0.2 | 11 | 6.0 | 0.54 | <0.03 |
| MD 3A | 8 | 7 | 0.4 | <0.1 | 2.4 | 0.7 | 18 | 7.4 | 0.5 | 0.06 |
| MD 3B | * | 8 | * | <0.1 | * | 0.5 | * | 7.6 | * | 0.06 |
| MD 4 | 7 | 11 | 0.1 | <0.1 | 1.8 | <0.1 | 14 | 2.8 | 0.3 | <0.03 |
| MD 5 | 8 | 8 | 0.3 | <0.1 | 2.7 | <0.1 | 13 | 6.2 | 0.56 | <0.03 |

| SITE | ATRAZINE (ug/L) | | E. COLI + (cfu/100ml) | | | CONDUCTIVITY (umho/cm) | |
|-------|-----------------|------|-----------------------|-----------|------------|------------------------|------|
| | Spring | Fall | 5/9/2003 | 6/12/2003 | 10/22/2003 | Spring | Fall |
| MD 1 | 5.78 | 0.28 | 1700 | 3900 | 61 | 549 | 777 |
| MD 2 | 5.63 | 0.27 | >2400 | 1900 | 140 | 468 | 766 |
| MD 3A | 8.29 | 0.43 | >2400 | 24000 | 71 | 513 | 785 |
| MD 3B | * | 0.34 | * | * | 79 | * | 786 |
| MD 4 | 6.95 | 0.17 | >2400 | 2000 | 290 | 546 | 788 |
| MD 5 | 7.62 | 0.25 | >2400 | 1400 | 64 | 446 | 686 |

(* Values for replicate samples at site MD 3 were not obtained for spring sampling.)

(+ Spring sampling was repeated on 6/12 to obtain a more accurate count.)

None of the streams in this project area are drinking water sources. Also, the streams are not typically used for swimming; however, wading is a potential use in the warmer months. Downstream, Little Deer and Deer Creeks are sizeable and do attract fishermen and, potentially, swimmers.

A DNA matching technique was used to identify the source of E. coli as either human or animal. This technique is expensive; therefore, only a subset of two sampling sites was selected from the original five. These were MD-1 and MD-2. A water sample was taken at each site after a rainfall of at least 0.5 inches on two separate occasions. The first sampling was on June 17, 2004. The second sampling was on July 7, 2004. Thus, the total number of samples analyzed was four. For each sample, five isolates are examined for DNA matching to human or animal sources. Results are in Table 3. The laboratory employed for this analysis was Source Molecular Corporation (telephone: 786-268-8363 / www.sourcemolecular.com).

| Table 3. E. Coliform Bacteria DNA Matching Analysis. | | | | | | |
|--|----------------------------|-------------------|-----------------|----------------------------|-------------------|-----------------|
| | June 17, 2004 | | | July 7, 2004 | | |
| Sampling Site | Fecal Coliform (mpn/100ml) | E. coli Isolate # | Probable Source | Fecal Coliform (mpn/100ml) | E. coli Isolate # | Probable Source |
| MD-1 | > 2,400 | 1 | Animal | 460 | 1 | Animal |
| | | 2 | Animal | | 2 | Animal |
| | | 3 | Animal | | 3 | Animal |
| | | 4 | Animal | | 4 | Animal |
| | | 5 | Human | | 5 | Animal |
| MD-2 | > 2,400 | 1 | Animal | 1,100 | 1 | Animal |
| | | 2 | Animal | | 2 | Animal |
| | | 3 | Animal | | 3 | Human |
| | | 4 | Animal | | 4 | Animal |
| | | 5 | Animal | | 5 | Animal |

Initially, stakeholders and project staff believed that malfunctioning or incorrectly installed septic systems would be a significant source of human E. coli during high stream flows. This belief was not supported by the DNA matching analysis. Only one isolate from two water samples was matched to a human source. The results show clearly that animals, including livestock, were primary sources of fecal waste contamination on both sampling dates. This does not rule out the likelihood that failing septic systems are also a source of contamination, although it may be minor in comparison to livestock sources.

In addition to impacts on human health, water quality was evaluated for support of aquatic life (animal and plant communities living in surface waters). Atrazine levels measured in both spring and fall water samples were below both chronic (long-term exposure) and acute (one-time exposure) standards set to protect aquatic life. As expected, turbidity (water clarity) is

high during high flows due to suspended particles, such as sediment, which can impact aquatic life by interfering with breathing, nesting, and food gathering. Dissolved oxygen levels are adequate in both spring and fall samples to support aquatic life. The pH levels are within the acceptable range for Indiana surface waters.

Spring water samples contain nutrient concentrations known to cause over-enrichment (or eutrophication) of the aquatic environment. Excess nutrients stimulate algae and plant growth in the stream. During daylight hours when photosynthesis occurs, plants introduce oxygen to the stream; however, the opposite occurs at night when plants require oxygen. When algae and plants are over-abundant, there are wide swings in available oxygen (from plenty to not enough) for aquatic animals such as fish and insects. In addition, the decomposition of large amounts of dead algae and plants consumes much oxygen, which can drastically reduce the amount available to aquatic animals. Locally, these impacts are noticeable but may not be dramatic; however, there are serious national concerns about the impacts of persistent loads of excess nutrients on the health of larger water bodies downstream such as the Wabash, Ohio, and Mississippi Rivers, and the Gulf of Mexico.

Indiana does not yet have water quality standards for nutrients, including ammonia, nitrogen and phosphorus. The US Environmental Protection Agency (USEPA) has issued nutrient criteria to guide states in the process of establishing standards. The objective is to reduce over-enrichment of surface waters caused by excess nutrient loads in runoff. The criteria are set for ecoregions (areas of similar geology, climate and soil type) and are representative numerical values modeled from a data base of several thousand field observations. The Little Deer Creek Headwaters project is in the Eastern Corn Belt Plains ecoregion that includes central Indiana and west central Ohio.

Ammonia: The ammonia levels measured in spring and fall do not exceed the USEPA acute and chronic criteria needed to support aquatic life.

Nitrogen: Total nitrogen concentrations in both spring and fall exceed the USEPA nutrient criteria to prevent eutrophication.

Phosphorus: Spring water samples have concentrations well above the USEPA nutrient criteria to prevent eutrophication. Fall samples are below the criteria. Total phosphorus (TP) concentrations of 0.03 mg/l are known to cause algal blooms. Three fall samples were above 0.03 mg/l.

Biological Monitoring

The Howard County SWCD subcontracted with Commonwealth Biomonitoring to perform biological testing of aquatic habitat and organisms according to the QAPP. Similar to the water testing, the subcontractor conducted two rounds of sampling in 2003 - one in the spring (May) and one in the fall (October). This testing was conducted at two sites in the Little Deer Creek Headwaters watershed and at a downstream reference site on Little Deer Creek at State Road 29 known to have a high quality aquatic community (Figure 3).

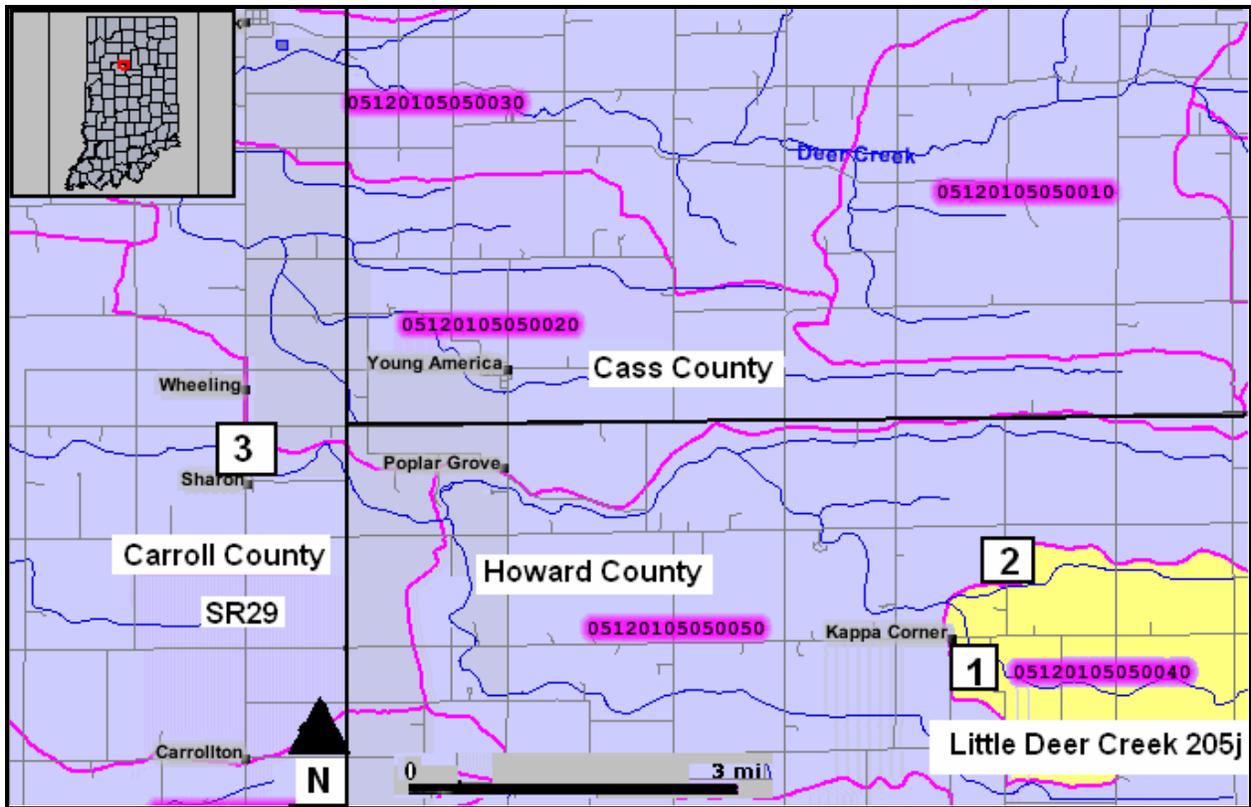


Figure 3. Biological sampling locations for the Little Deer Creek Headwaters Watershed.

The subcontractor used a series of tests to rate the aquatic habitat and biological condition of the stream at each monitoring site. Test results are compiled into a habitat index and a biotic index for each site. These scores were normalized based on the reference site. The reference site represents a “perfect” score of 100 for comparison against scores from the other two monitoring sites. There are two evaluations to make. First, the habitat and biotic indices from any site can be assessed as “poor, fair, good, or excellent” by direct comparison with the reference site. Second, the difference between the habitat and biotic indices for individual sites may indicate water quality impairment upstream. If this difference is significant (either negative or positive) then habitat and biotic indices do not correlate well, indicating an external impact is affecting the values.

Results (Table 4) show that in comparison with the reference site (3), sites 1 and 2 have only fair habitat “due to artificial channelization and the lack of riparian vegetation or shading canopy” (*Watershed Bioassessment Report: Headwaters of Little Deer Creek and Pete’s Run. May and October, 2003. Commonwealth Biomonitoring, Indianapolis, IN, June 2005*). This is not surprising as many streams in this watershed are maintained as drainage ditches and have few characteristics of good quality aquatic habitat.

Table 4. Results of Biological Monitoring for Little Deer Creek Headwaters Watershed, May 2003 (Commonwealth Biomonitoring).

| Sampling Site (map #) | Habitat Index | Biotic Index | Difference | Level of Water Quality Impairment |
|--------------------------|------------------|--------------|------------|--------------------------------------|
| 1 | 58 | 27 | - 31 | Severe |
| 2 | 54 | 95 | + 41 | Severe |
| 3 Reference Site | 100 | 100 | 0 | None |

Habitat and Biotic Index scores are normalized based on the reference site.

The biological community was good at site 2 but only fair at site 1. The biotic index at both sites 2 and 1 differs significantly from the value predicted by the habitat index (see Table 4). This indicates severe water quality impairment above sites 1 (McKay Dredge sub-watershed) and 2 (Harrison-Harlan Ditch sub-watershed). The sample of benthic (bottom-dwelling) organisms from these two sites was dominated by algae scrapers, which suggests excessive nutrient inputs, especially for the Harrison-Harlan sub-watershed. Biological monitoring also indicated that a toxic substance may have impacted this sub-watershed in May 2003, because the benthic organism sample lacked specimens that are sensitive to toxic substances. The full report by Commonwealth Biomonitoring is on file at the Howard County SWCD.

PROBABLE WATER QUALITY PROBLEMS and SOURCES

The following is a list of water quality problem statements for the Little Deer Creek Headwaters project area. These statements are based on information gathered at stakeholder meetings, from the windshield survey of the watershed, and from local agriculture and natural resource professionals.

❖ Fecal Waste Contamination of Surface Water

- Causes/Sources:
 - livestock waste storage and disposal
 - septic system malfunction or old system with no filtration field
- Location:
 - manure storage sites and cropland receiving manure applications
 - residences
- Extent:
 - 60% of cropland
 - potentially all residences with septic systems more than 30 years old

❖ Herbicide and Nutrient Movement Off-Site to Surface Water

- Causes/Sources:
 - timing of chemical application
 - drainage tiles and tile risers in crop fields
 - possible surface runoff – stream buffers not adequate to slow runoff
- Location:
 - cropland
- Extent:
 - 60 % of cropland

❖ Sedimentation of Surface Water

- Causes/Sources:
 - steep ditch bank slopes that are susceptible to collapse
 - destruction of vegetation along stream banks
 - loss of floodwater retention areas upstream
 - sheet and rill erosion of cropland
- Location:
 - primarily along streams and ditches
- Extent:
 - 5 miles of ditch length

Critical Areas for Land Treatment

Critical areas for implementing water quality protection practices were identified by comparing pollutant loads and yields from individual sub-watersheds. The project area was divided into has five sub-watersheds (Figure 4) defined by the location of water sampling sites (Table 5). The size of each sub-watershed was estimated from 1:20,000 scale soil maps using an acreage measuring grid.

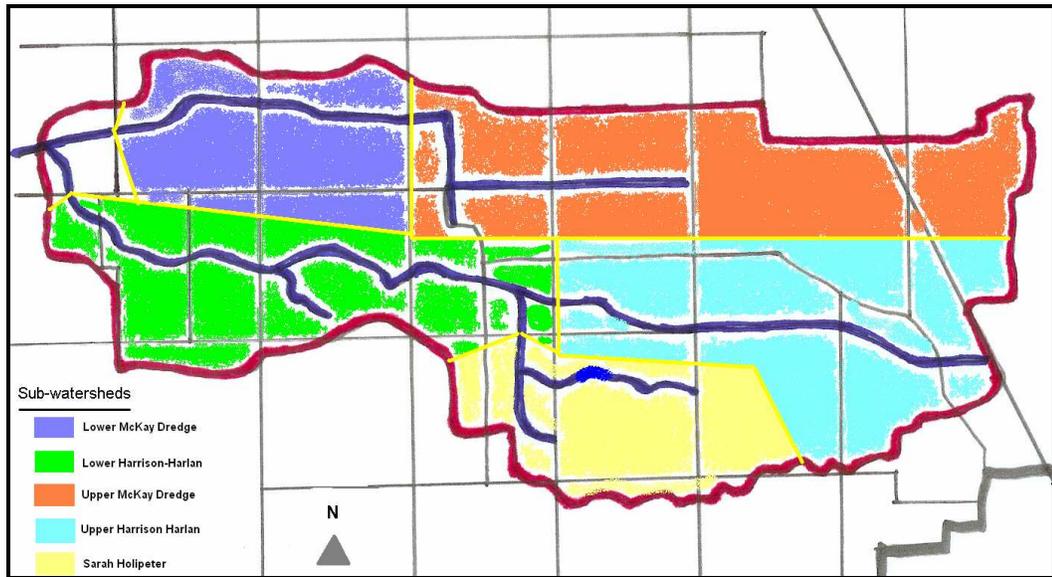


Figure 4. Estimated Sub-watersheds of Little Deer Creek Headwaters 205j Project.

| Sub-watershed Name | Estimated Acres | Sub-watershed Outlet Water Sampling Site |
|---|-----------------|--|
| Lower McKay Dredge ¹ | 1,100 | MD 1 (MD 3) |
| Lower Harrison Harlan Ditch ¹ | 2,250 | MD 2 (MD 4 & 5) |
| Upper McKay Dredge Ditch | 2,525 | MD 3 |
| Sarah Holipeter Ditch | 1,400 | MD 4 |
| Upper Harrison Harlan Ditch | 1,950 | MD 5 |
| ¹ These locations also include inputs from upstream sub-watersheds named in parentheses. | | |

Pollutant Loads

The quantity of pollutant leaving a watershed over time is called a load. Comparison of pollutant loads is useful for identifying problem areas (critical areas) within a watershed. Pollutant loads were calculated for each sub-watershed using test results for spring and fall water samples plus stream discharge measurements (Table 6). Although this is a rough analysis and there are only two water samples to compare at each site, this approach helps in locating needs for certain conservation practices.

| Table 6. Pollutant Loads Leaving Little Deer Creek Headwaters Watershed During High and Low Stream Flow. | | |
|--|----------------------------------|-------------------------------|
| Pollutant | Spring (high flow) Total Load | Fall (low flow) Total Load |
| Ammonia | 119 (lbs/day) | 3 (lbs/day) |
| Total Kjeldahl Nitrogen | 1,523 (lbs/day) | 23 (lbs/day) |
| Nitrite+Nitrate | 9,109 (lbs/day) | 354 (lbs/day) |
| Total Phosphorus | 338 (lbs/day) | 2 (lbs/day) |
| Atrazine | 1850 (g/day) | 7 (g/day) |
| E. Coliform bacteria | 8.E + 12 (cfu/day) | 2.E +10 (cfu/day) |

Pollutant loads in spring runoff are much higher than in fall stream flow as shown in Figures 5-10. The three most upstream sub-watersheds (Upper McKay Dredge, Sarah Holipeter and Upper Harrison Harlan) carry significant loads of nitrogen and phosphorus when stream discharge is high, such as after a rain event of at least 0.5" as was measured in this project. Pollutant loading drops to low levels when discharge falls. High loads are usually associated with agricultural activities that take place during spring when vegetative cover to protect soils from rains is at a minimum and the application of manure and chemicals (pesticides and fertilizers) is taking place. Failing or incomplete septic systems are also a source of nutrient loading.

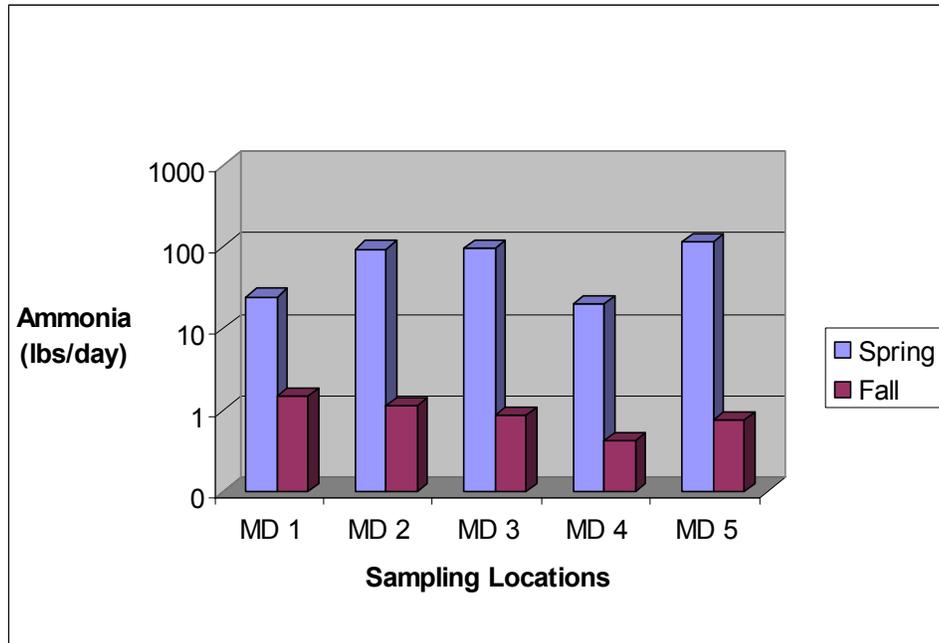


Figure 5. Ammonia Load: Spring vs. Fall (2003)

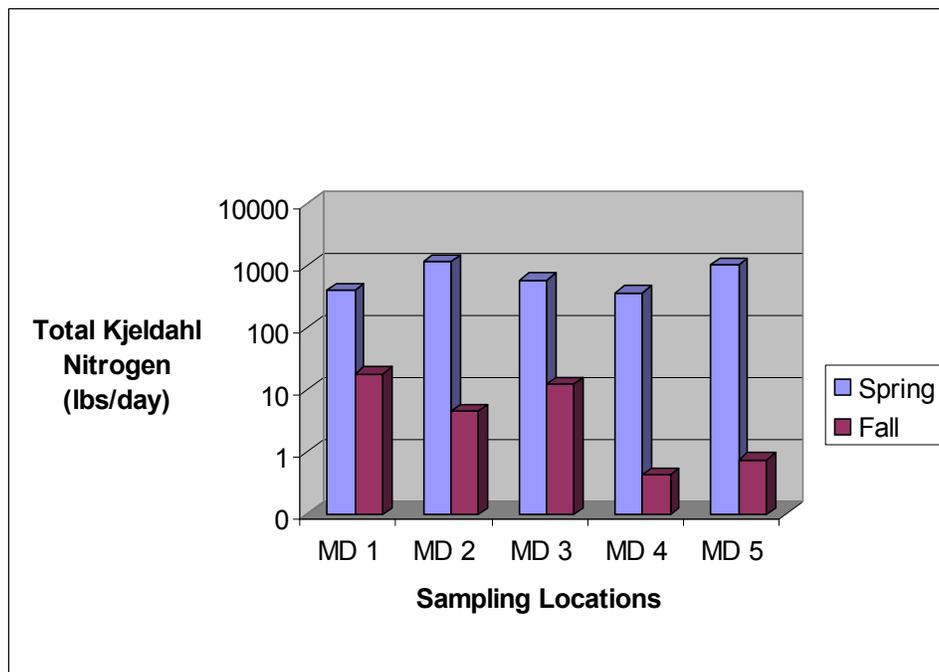


Figure 6. Total Kjeldahl Nitrogen Load: Spring vs. Fall (2003)

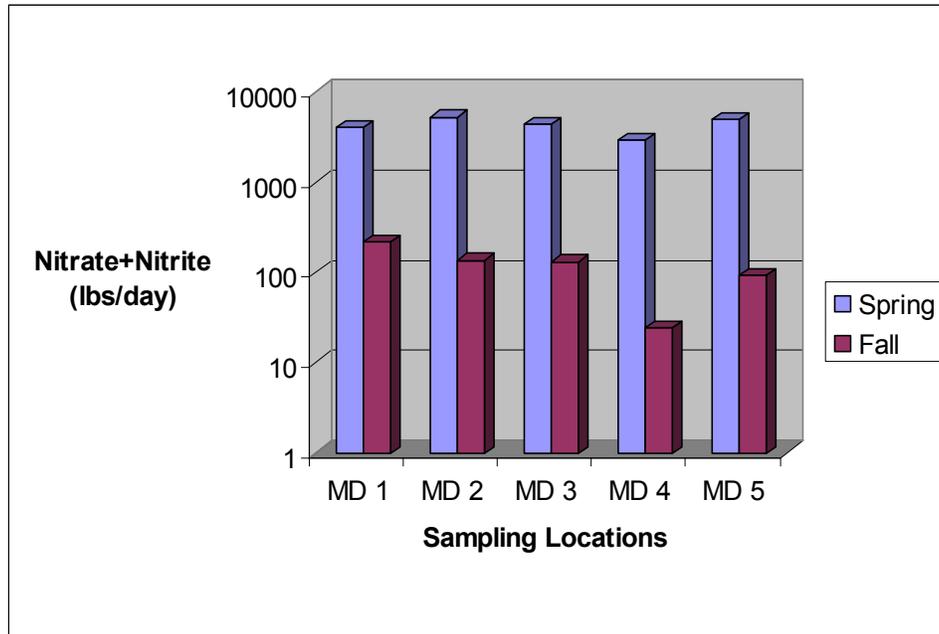


Figure 7. Nitrate + Nitrite Load: Spring vs. Fall (2003)

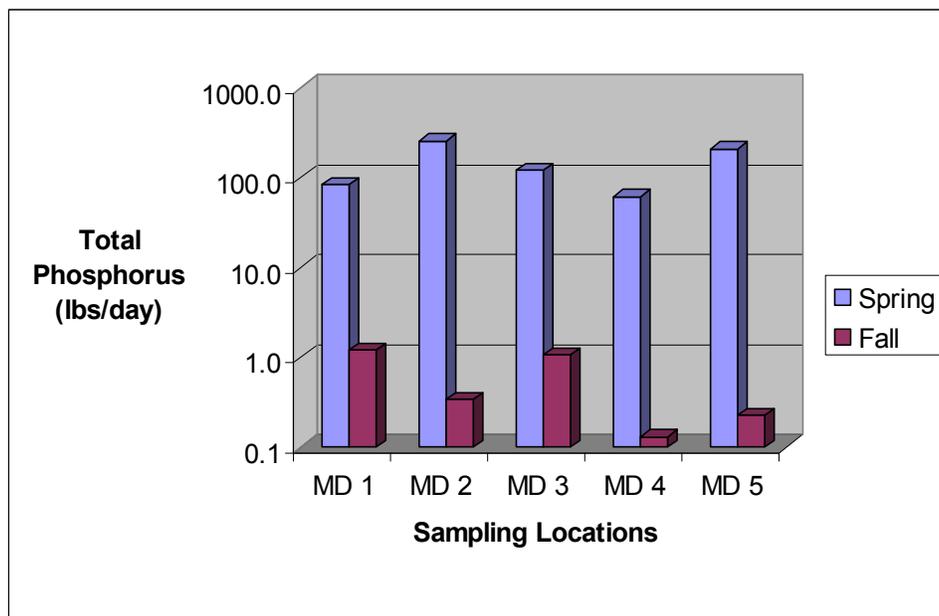


Figure 8. Total Phosphorus Load: Spring vs. Fall (2003)

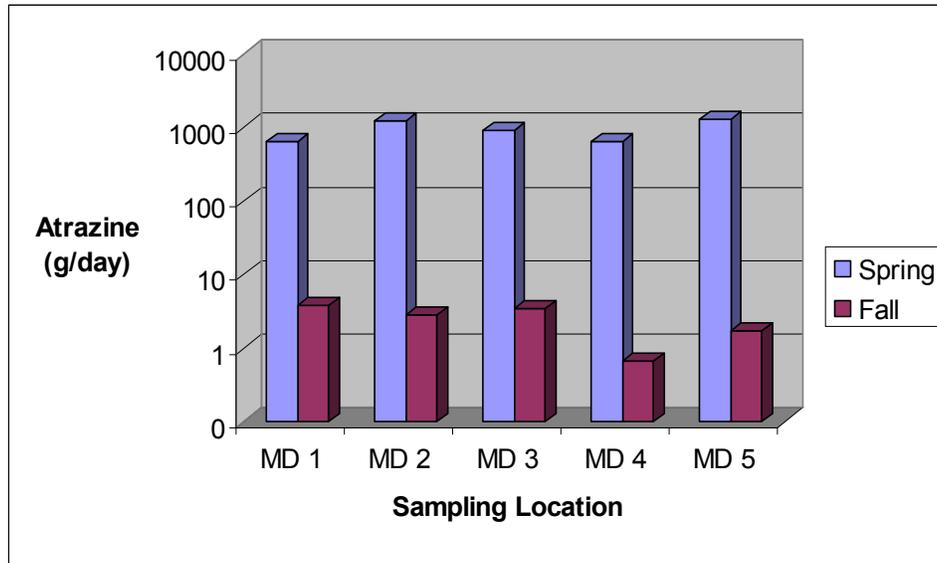


Figure 9. Atrazine Load: Spring vs. Fall (2003)

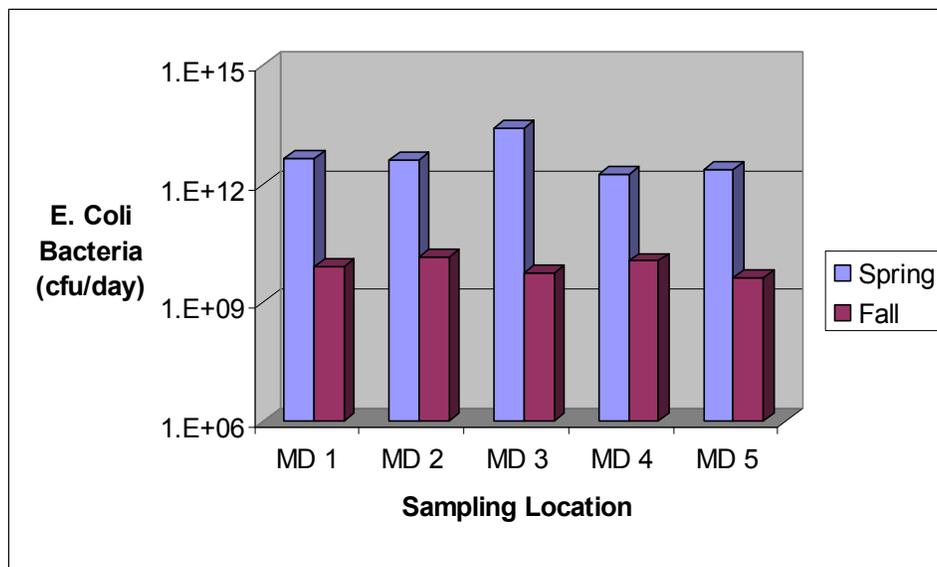


Figure 10. E. Coli Bacteria Load: Spring vs. Fall (2003)

Pollutant Yields

Another method of comparing the amount of pollutants contributed from different sub-watersheds is to calculate the yield (load divided by drainage area), or the amount of pollutant generated per acre in each sub-watershed. Figures 11 and 12 show that all three headwaters watersheds are fairly close in nutrient and Atrazine yield, but the Upper Harrison Harlan (above MD 5) sub-watershed has slightly greater pollutant yields.

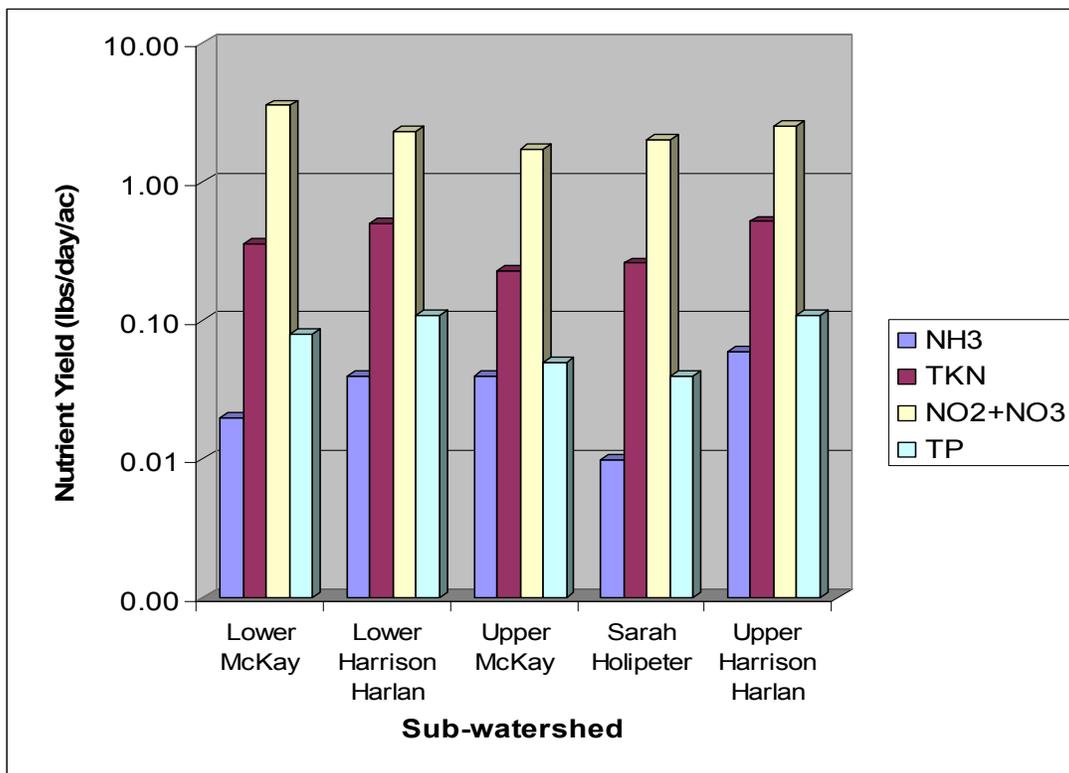


Figure 11. Nutrient Yield From Sub-watersheds: Spring (2003)

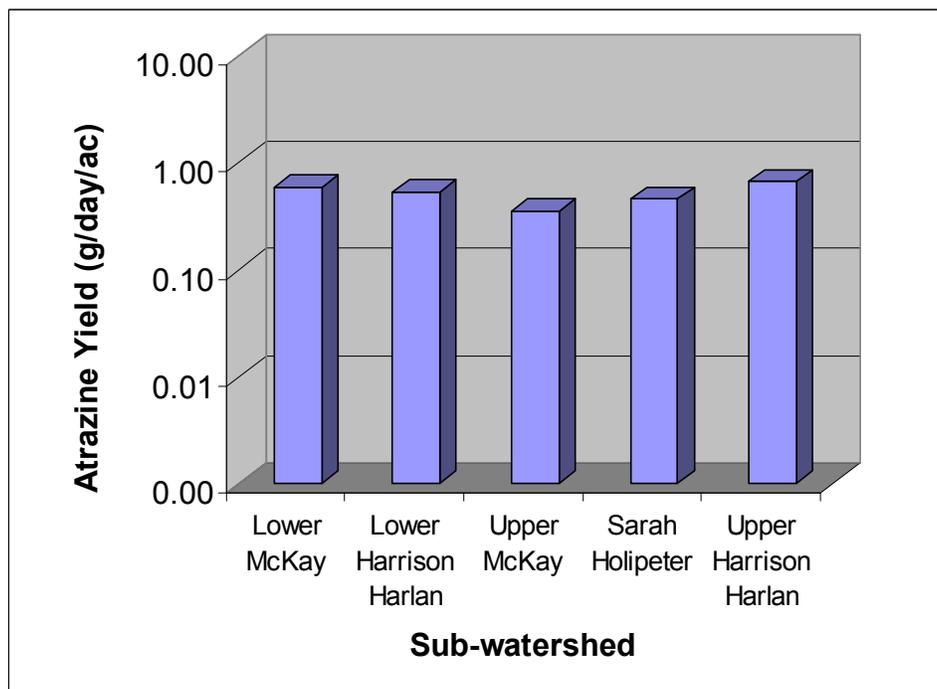


Figure 12. Atrazine Yields From Sub-watersheds: Spring (2003)

E. Coli bacteria loads are shown in Figure 13. The Upper McKay sub-watershed has the greatest yield by far. This sub-watershed has some livestock but not as much as other areas of the Little Deer Headwaters area. The Upper McKay sub-watershed does have a group of several residences located next to the drainage ditch one mile upstream from sampling site MD-3. The downstream biological monitoring site on McKay Dredge Ditch has a poor biotic index (score of 27) due to nutrient enrichment, possibly from failing septic systems or manure. The E. coli DNA matching results (Table 3) show a human match on one sampling date, but the sampling site was downstream from site MD-3 and includes flows from other sub-watersheds. The water quality data from the Upper McKay Dredge area suggest a problem due to fecal waste contamination; however, there is not enough information to identify an exact source of contamination.

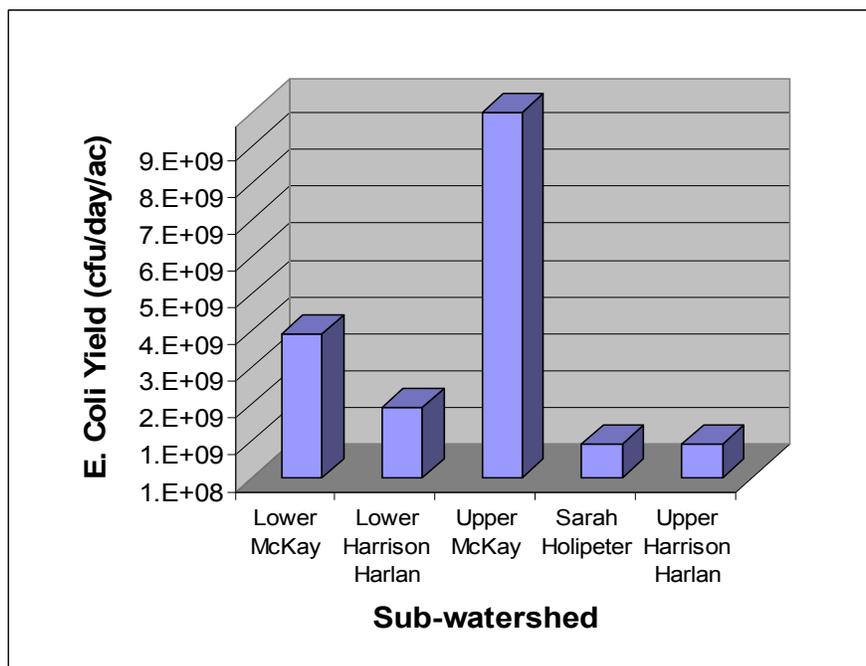


Figure 13. E. Coli Bacteria Yields From Sub-watersheds: Spring (2003).

Clearly, the sub-watersheds (Lower McKay Dredge and Lower Harrison-Harlan Ditch) also contribute to all pollutant yields, but these amounts are difficult to differentiate from upstream inputs. Therefore, top priority areas for nutrient management are the Upper Harrison-Harlan and Upper McKay sub-watersheds. The Upper McKay Dredge sub-watershed is the top priority area for practices to address fecal waste contamination, including both manure management and education about septic systems. Beyond this sub-watershed, manure management should be promoted to all livestock producers within the project area because E. coli numbers are fairly high in spring runoff at all sampling sites.

WATERSHED MANAGEMENT GOALS

The watershed management goal is to reduce peak pollutant loads associated with rain events. The expectation is that implementation of selected conservation practices for agriculture combined with educational programs about water quality and land use will result in lowered pollutant loads. Estimating the reduction in pollutant loads associated with these activities is difficult; nonetheless, estimates based on good information are useful for planning purposes. For this watershed, there is one set of water quality data (high flow and low flow) and one set of biological data. Both sets indicate that water uses are impaired by pollutants moving off-site during rain events. Therefore, land treatment is proposed to reduce polluted runoff.

In Table 7, the environmental goal is paired with the associated conservation practices needed to address the goal. In addition to stakeholder concerns, the watershed coordinator used input from the 205j steering committee, USDA-NRCS District Conservationist, IDNR Resource Specialist, and Howard SWCD Resource Conservationist to select and prioritize conservation practices. This table also includes the priority area for land treatment and the responsible party for overseeing implementation.

| Table 7. Land Treatment Measures to Achieve Environmental Goals. | | | |
|--|--|---|---|
| Environmental Goal | Land Treatment Measure ^a | Priority Area | Responsible Party (specifications) |
| Reduce animal waste contamination of surface water | 590–nutrient mgmt. 633-livestock waste utilization 313-manure storage pits | All livestock producers | USDA Natural Resources Conservation Service (Field Office Technical Guide) |
| Reduce nutrient and Atrazine loads at watershed outlet | 393-filter strips 590-nutrient mgmt. 595-pest mgmt. | Upper McKay Dredge and Upper Harrison Harlan sub-watersheds | Howard SWCD Purdue Cooperative Extension Service (educational materials) |
| Reduce soil loss | 393-filter strips 410-grade stabilization structures | Upper McKay Dredge and Upper Harrison Harlan sub-watersheds | USDA Natural Resources Conservation Service (Field Office Technical Guide) Howard SWCD |
| ^a numbers correspond to NRCS conservation practice numbers for cost-share programs. | | | |

Pollutant Load Reductions

Target levels for land treatment were determined by the watershed coordinator, SWCD Board, NRCS District Conservationist, and DNR Resource Specialists. These levels were established based on the amount of cropland receiving manure and chemical applications where improved management would have a positive effect on water quality. The estimate for grade stabilization structures is from sites within the watershed that would benefit from this practice. Using these levels of land treatment, the IDEM Loading Workbook (Microsoft Excel spreadsheet) was used to calculate estimated pollutant load reductions. Results are shown in Table 8. The computer program does not include calculations for Atrazine and E. coliform bacteria. Workbook worksheets are in Appendix H.

| Table 8. Pollutant Load Reductions Estimated With IDEM Loading Workbook. | | | |
|---|---|--|---|
| Conservation Practices | Sediment (tons/year) | Phosphorus (lbs/year) | Nitrogen (lbs/year) |
| 3,500 cropland acres in tillage system (corn-fall chisel / beans-fall chisel / spring-fall cultivate) | 861 | 1,080 | 2,159 |
| 73 acres of filter strips | 2,240 | 4,148 | 7,730 |
| 25 grade stabilization structures | 200 (25 units x 8 tons/year/unit) | 200 (25 units x 8 lbs/year/unit) | 400 (25 units x 16 lbs/year/unit) |
| Total | 3,301 | 5,428 | 9,889 |

The total pollutant load reductions in Table 8 are rough estimates. They do not reflect additional nutrient load reductions associated with improved nutrient (including manure) management and manure storage structures.

Utilizing the available water quality data and estimated load reductions, this plan proposes a target level of 30 percent (or greater) reduction in levels of nutrients, sediment, E. coliform bacteria, and Atrazine herbicide measured in stream flow after a rain event of 0.5 inches or more. Where water quality standards exist (E. coli – contact recreation, Atrazine – aquatic life), such standards are the target level. Note that peak ammonia and Atrazine concentrations currently do not violate aquatic life support standards; however, any reduction in these pollutants lost to surface runoff will be measured as a favorable accomplishment. If the state of Indiana

establishes water quality standards for nutrients, these standards become the target goal for nutrients.

This reduction is considered achievable based on estimated land treatment needs. Table 9 lists goals, target reductions for pollutants, and indicators of progress toward the goals. The target date is five years from the beginning of an implementation project. This date reflects a period of time desired to achieve sufficient land treatment and evaluate water quality impacts.

| Table 9. Target Levels for Pollutant Load Reduction. | | | |
|--|--|---|--|
| Goals | Present Pollutant Level | Target Pollutant Level | Progress Indicators |
| Reduce animal waste contamination of surface water | E. coli bacteria levels above 235 cfu/100ml | 235 cfu/100 ml (primary contact recreation) | Acres of best management practices for manure and adequate manure storage facilities Acres of best management practices for nutrients and pesticides Acres of riparian filter strips installed Acres of reduced tillage and number of erosion control practices installed |
| Reduce nutrient loads & peak Atrazine concentration after spring rain at watershed outlet sampling sites 1 & 2 | Pollutant Loads: Ammonia: 119 lbs/day TKN: 1,523 lbs/day Nitrite+Nitrate: 9,109 lbs/day Total Phosphorus: 338 lbs/day Atrazine: 8.29 ug/l 2003 Aquatic Biotic Index Site 1: 50 Site 2: 77 | 30 % reduction from spring 2003 samples in 205j plan Improvement in index score (min. -- no change in score) | |
| Reduce sedimentation of surface waters | Turbidity levels above 200 NTU in spring runoff | 30% Reduction from spring samples in 205j plan | |

Educational Programs

In addition to the selected measures for land treatment, there are five topic areas where education is needed to address stakeholders' concerns and support overall watershed management goals. These areas are septic system installation and maintenance, drainage and ditch maintenance, dumping, drinking water protection, and wildlife habitat. Proposed measures to provide education on these topics are listed in Table 10.

Most stakeholders who attended the project meetings were overwhelmingly concerned with drainage and ditch maintenance. Flat topography, the loss of wetlands for floodwater storage, broken tile and obstructed drainage ditches all contribute to widespread ponding of water after significant rains. This may be impacting septic system function as well as interfering with many other land use activities.

| Table 10. Education Measures to Support Watershed Management Goals. | | | |
|---|---|---|--------------------------------------|
| Topic | Activity | Target Audience | Responsible Party |
| Septic System Maintenance | Offer a series of 3 community meetings | All residents using septic systems for on-site wastewater treatment | County Health Department |
| Drainage and Ditch Maintenance | Develop a drainage and ditch maintenance manual for homeowners | All landowners paying ditch assessment tax | County Surveyor's Office |
| Dumping | Place county ordinance signs and enforce violations | Where dumping occurs regularly at selected stream crossings | County Government |
| Drinking Water Protection | Offer Farm-A-Syst and Home-A-Syst to educate landowners about drinking water protection | All interested landowners | Purdue Cooperative Extension Service |
| Wildlife Habitat | Promote wildlife habitat plantings | All interested landowners | Howard County SWCD |

Techniques planned for encouraging public awareness and participation in water quality protection include personal contacts, public meetings, direct mailings, and public exhibits (county fair, field days, demonstrations, etc.).

Potential Impacts: Costs, Benefits

The primary potential impact is improved water quality at the watershed outlet. There are economic benefits to this that could be attached to reductions in lost fertilizer and herbicide locally, as well as downstream improvements in water quality for drinking, recreation, and improved aquatic health. Additional benefits could include greater efficiency in agricultural pest and nutrient management, enhanced environmental values (e.g., landscape beauty, presence of wildlife, quality of stream habitat and biota), and greater social responsibility for local land use issues.

The majority of costs associated with nonpoint pollution control are born by the public who fund cost-share implementation programs. Some costs for educational programs will be shared with local cooperating agencies. Significant private costs that are not covered by cost-share programs are associated with fixing septic systems. These costs are often cited as a deterrent to addressing this problem. Some water quality monitoring costs may be shared with the Howard County Health Department and the Indiana-American Water Company office in Kokomo, Indiana.

The consequences of doing nothing include continued violation of water quality standards for certain pollutants, worsened water quality in some streams, further loss of aquatic habitat, and loss of public support for local land use planning and conservation.

IMPLEMENTATION STRATEGY

Tasks and Timeline

The tasks and estimated financial resources for implementing this watershed management plan are listed in Table 11. This table also includes a timeline for completing tasks in each year of a five-year project.

| Table 11. Implementation Tasks, Timeline and Estimated Resources Needed. | | | |
|---|--|--|---|
| Tasks | Implementation Timeline (5 year project) | Responsible Party | Estimated Resources Needed |
| Manure Management on 40% of cropland receiving manure (3,500 acres) 10 storage units | Year 1: 1,000 ac / 5 storage units Year 2: 2,000 ac / 5 storage units Year 3: 500 ac | USDA NRCS Purdue CES IDNR Howard Co. SWCD | \$315,000 planning \$75,000 equipment \$175,000 manure storage \$2,000 CES materials |
| Nutrient and Pest Management on 40% of cropland (3,500 acres) | Year 1: 1,000 ac Year 2: 2,000 ac Year 3: 500 ac | USDA NRCS Purdue CES IDNR Howard Co. SWCD | \$94,500 cost share \$2,000 CES materials |
| Riparian filter strips along 5 miles of ditch (73 acres) | Year 1: 1 mile Year 2: 2 miles Year 3: 2 miles | USDA NRCS IDNR Howard Co. SWCD | \$10,950 CRP (\$150 per acre) |
| Grade stabilization structures along ditches (25 units) | Year 1: 10 units Year 2: 10 units Year 3: 5 units | USDA NRCS IDNR Howard Co. SWCD | \$162,500 cost-share |
| Offer 3 educational meetings on septic systems | Year 1, 2, 3 | SWCD with County Health Department | \$3,000 |
| Develop & distribute homeowners' guide to ditch & tile maintenance | Year 2, 3 | SWCD with County Surveyor's Department | \$3,000 |
| Display & distribute Farm-A-Syst & Home-A-Syst | Year 2, 3 | Purdue CES | \$1,000 |
| Hire Watershed Coordinator | Year 1 | Howard Co. SWCD | \$40,000 |
| Water Quality Monitoring (surface water variables, biological monitoring & E. coli virus source i.d.) | Year 1: virus matching Year 3, 4, 5: surface water Year 5: biological | Howard Co. SWCD with cooperators | \$12,000 |
| | | Grand Total | \$895,950 |

Monitoring and Evaluation

The implementation and effectiveness of this plan will be monitored in three ways: water quality testing, adoption of best management practices, and landowner contacts for information or assistance.

In the first year of the implementation project, water samples from each sampling site should be collected for E. coli virus matching. This technique provides more detail for pollutant source matching. The E. coli in a water sample can be matched to a specific animal (e.g., swine, cattle, poultry, human), which would be valuable information to use when talking with stakeholders about the E. coli contamination problem.

Follow-up water quality monitoring of peak runoff events should be planned for the third through fifth year of the implementation project. The monitoring design could be grab sampling similar to what was conducted for this plan; but the sampling frequency should be increased to cover multiple events of at least 0.5 inches rainfall during May and June. Monitoring should continue at all sites (MD-1 through MD-5). Sample analysis may be handled by the same cooperators participating in the watershed planning phase (Indiana American Water Company – Atrazine testing, and Howard County Health Department – E. coli bacteria plus nutrients). The watershed coordinator will be responsible for collecting water samples and transporting them for analysis. Follow-up monitoring should also include biological monitoring at the end of the implementation project. The purpose is to compare the pre- and post-implementation scores for aquatic habitat and biological community.

The adoption of nutrient (including manure) and pest management practices implemented under USDA, IDNR or IDEM cost share programs will be monitored by recording practices and mapping the tracts involved. Contacts with landowners, either individually or in a group, will be recorded to indicate progress for educational programs. This includes requests for printed material, on-site visits, and educational meetings.

CONCLUSION

The Little Deer Creek Headwaters Watershed Management Plan was developed over two years and funded by a Clean Water Act Section 205j grant from the Indiana Department of Environmental Management. This plan identifies concerns about water quality held by local landowners and natural resource professionals, and proposes a strategy for addressing these concerns through implementing best management practices and educating the public about water quality. This plan does not contain mandatory or legally binding recommendations. It is intended to provide guidance for water quality protection efforts in the Little Deer Creek Headwaters watershed of Howard County, Indiana.

A copy of this plan is on file at the Kokomo-Howard County Public Library. Lists of contributors to this written plan and its distribution are in Appendix I. Comments or questions about the plan should be directed to the Howard County Soil and Water Conservation District, 1103 S. Goyer Rd., Kokomo, Indiana 46902, telephone (765)457-2114(ext. 3).

Appendix A: Watershed Assessment Survey

McKay and Harrison-Harlan

Thank you for helping with the development of the Pete’s Run and McKay Dredge-Harrison Harlan Ditch Watershed Management Plans. In order to evaluate the success of this grant project, we will conduct a survey of stakeholder’s knowledge and concerns at the beginning and end of the two-year grant period. Please assist us by taking a few minutes to fill out this anonymous survey. If you have any questions please contact the Howard County Soil and Water Conservation District at (765) 457-2114 ext. 3.

| | <u>Agree</u> | <u>Disagree</u> | <u>Unsure</u> |
|---|--------------|-----------------|---------------|
| <u>Soil, Fertilizers and Nutrients</u> | | | |
| 1. What I do on my property affects water quality no matter how far away I live from a stream or ditch. | 10(91%) | 1(9%) | 0 |
| 2. I would like the ditches and streams in my watershed to have clean enough water to be considered safe for fishing and swimming by the state of Indiana. | 9(82%) | 2(18%) | 0 |
| 3. I am concerned about keeping water in my watershed clean for people who live downstream and for future generations. | 11(100%) | 0 | 0 |
| 4. I have used a soil testing kit or service to determine how much fertilizer to put on my yard, garden or farm field. | 2(22%) | 5(56%) | 2(22%) |
| 5. I leave grass clippings or crop residue on my property to reduce the amount of fertilizer it needs. | 10(91%) | 1(9%) | 0 |
| 6. I typically identify nuisance pests before selecting and applying a pesticide to treat them. | 7(88%) | 1(12%) | 0 |
| 7. I am familiar with soil and water conservation practices such as filterstrips, tree plantings, grass waterways, grade stabilization structures, crop scouting & nutrient management. | 5(56%) | 3(33%) | 1(11%) |

Please list any conservation practices you have installed or performed (including composting, mulching, water conservation, recycling, etc.)

Recycle (2), Mulching (2), Water Conservation (1), Composting (1)

Septic Systems

| | | | |
|---|----------|-------|-------|
| 1. The wastewater from my home is treated by a septic system. | 11(100%) | 0 | 0 |
| 2. I know where my septic system is located. | 11(100%) | 0 | 0 |
| 3. Periodic maintenance is performed on my septic system. (i.e. cleaning out septic tank, checking baffles) | 11(100%) | 0 | 0 |
| 4. My septic system consists of a septic tank & absorption field. | 10(100%) | 0 | 0 |
| 5. I am careful about putting garbage disposal waste and household chemicals in my septic system. | 9(82%) | 1(9%) | 1(9%) |

| | <u>Agree</u> | <u>Disagree</u> | <u>Unsure</u> |
|--|--------------|-----------------|---------------|
| <u>Planning and Zoning, Forestry and Stormwater</u> | | | |
| 1. Planning and zoning is important to protect water quality. | 11(100%) | 0 | 0 |
| 2. Planting and maintaining existing tree stands is important to protect water quality. | 10(100%) | 0 | 0 |
| 3. Managing stormwater from rain events is important to protect water quality. (i.e. retention ponds, buffers) | 7(78%) | 0 | 2(22%) |

Respondents: 8(89%) adults 1(11%) students

Background: 2(29%) agricultural 5(71%) non-agricultural

Comments and concerns: Soil Testing for Septic Systems, Landfill Material

Appendix B: List of Meetings for 205j Plan Development

January 2003 – December 2004

Steering Committee

2003

March 19

April 23

May 22

June 25

July 23

August 27

September 12

October 22

November 19

December 17

2004

January 28

February 18

March 17

May 19

June 23

July 28

August 25

September 22

October 27

Stakeholder Meetings

2003

April 1

June 3

August 19

November 3

2004

January 26

March 15

June 29

September 2

Appendix C : IDEM 303(d) List of Impaired Waterbodies

| Waterbody Segment ID | Hydrologic Unit Code | Waterbody Segment Name | Size | Units | Draft Year 303(d) | Aquatic Life Support | Drinking Water Supply | Fish Consumption | Primary Contact | PCBs | Mercury | Assessment Date (yyyymmdd) |
|----------------------|----------------------|------------------------|------|-------|-------------------|----------------------|-----------------------|------------------|-----------------|------|---------|----------------------------|
|----------------------|----------------------|------------------------|------|-------|-------------------|----------------------|-----------------------|------------------|-----------------|------|---------|----------------------------|

| | | | | | | | | | | | | |
|---------------|----------------|--|------|-------|------|---|--|---|---|---|---|----------|
| INB0554_00 | 05120105050040 | MCKAY DREDGE DITCH - HARRISON HARLAN DITCH | 17.0 | Miles | | X | | X | X | | | |
| INB0555_00 | 05120105050050 | LITTLE DEER CREEK - HENRY GILBERT DITCH | 19.8 | Miles | | X | | X | X | | | |
| INB0556_00 | 05120105050060 | Little Deer Creek including Ridenour Ditch | 8.0 | Miles | | X | | X | X | | | |
| INB0556_T1016 | 05120105050060 | Deer Creek above Ridenour Ditch | 6.4 | Miles | | F | | X | X | | | |
| INB0557_00 | 05120105050070 | PAINT CREEK | 17.7 | Miles | | F | | X | X | | | |
| INB0558_00 | 05120105050080 | DEER CREEK - tributaries near CAMDEN | 0.7 | Miles | | X | | X | X | | | |
| INB0558_T1007 | 05120105050080 | Deer Creek | 8.9 | Miles | 1998 | X | | P | X | M | S | 19980301 |

Support for Designated Use

F = fully supporting
P = partially supporting
N = not supporting
X = not assessed

Level of Contamination

H = high
M = moderate
S = slight

Appendix D: Indiana State Department of Health Fish Consumption Advisory

| 2004 Indiana Fish Consumption Advisory: Streams and Rivers | | | | |
|--|-----------------|--------------------|-------------|-------|
| Location | Species | Fish Size (inches) | Contaminant | Group |
| Deer Creek Carroll County | Carp | Up to 19 | PCBs | 2 |
| | | 19+ | PCBs | 3 |
| | Smallmouth Bass | 10+ | PCBs | 3 |
| <p><u>General Population</u> Group 2 = 1 meal/week Group 3 = 1 meal/month</p> <p><u>Women of childbearing years, nursing mothers, and children under age 15.</u> Group 2 = 1 meal/month Group 3 = DO NOT EAT</p> | | | | |

Appendix E: List of Confined Feeding Operations in Little Deer Headwaters 205j Project Area

| Operation/Owner | Operation Location | Animals |
|------------------------|---------------------------|----------------|
| Ortman Farms Inc. | 450 N 400 W | Swine |
| Hartman | 600 W 400 N | Swine |
| Lovelace Farm | 350 N 400 W | Swine |
| Wilson | 750 W 300 N | Swine |
| Schultz Farm | 400 N 500 W | Swine |
| Jackson | 100 W 400 N | Swine |

Appendix F: Endangered Species for Howard County

| Endangered, Threatened, and Rare Species Documented from Howard County, Indiana. (IDNR Nature Preserves Division, 11/12/99) | | | |
|--|------------------------------|-------------|------------|
| Species Name | Common Name | State | Federal |
| Vascular Plant | | | |
| Crataegus Pedicellata | Scarlet Hawthorn | Threatened | Not Listed |
| Crataegus Prona | Illinois Hawthorn | Endangered | Not Listed |
| Crataegus Succulenta | Fleshy Hawthorn | Rare | Not Listed |
| Glyceria Grandis | American Manna-Grass | Extirpated | Not Listed |
| Linum Sulcatum | Grooved Yellow Flax | Rare | Not Listed |
| Reptiles | | | |
| Thamnophis Butleri | Butler's Garter Snake | Endangered | Not Listed |
| Birds | | | |
| Ardea Herodias | Great Blue Heron | Endangered | Not Listed |
| Mammals | | | |
| Lynx Rufus | Bobcat | Endangered | Not Listed |
| Myotis Sodalis | Indiana Bat | Endangered | Endangered |
| High Quality Natural Community | | | |
| Forest – Flatwoods Central Till Plain | Central Till Plain Flatwoods | Significant | Not Listed |

Appendix G: Latitude and Longitude Coordinates for Water Sampling Locations

| Site Name | Location | Latitude | Longitude |
|------------------|--------------------------------|---------------------------|---------------------------|
| MD-1 | McKay Dredge at 700 W | N 40 ⁰ 32.373' | W 86 ⁰ 15.678' |
| MD-2 | Harrison-Harlan Ditch at 400 N | N 40 ⁰ 31.978' | W 86 ⁰ 16.086' |
| MD-3 | McKay Dredge at 500 W | N 40 ⁰ 32.431' | W 86 ⁰ 13.338' |
| MD-4 | Sarah Holipeter Ditch at 300 N | N 40 ⁰ 31.135' | W 86 ⁰ 12.470' |
| MD-5 | Harrison-Harlan Ditch at 400 W | N 40 ⁰ 31.317' | W 86 ⁰ 12.187' |

Appendix H: IDEM Pollutant Load Reduction Worksheets

Agricultural Fields and Filter Strips

Please fill in the gray areas below. Once you have successfully estimated the sediment and nutrient load reductions, please print two (2) copies of this worksheet. Attach both copies to the 319A or 319U cost-share form. If you have any questions, please contact Wes Stone (317/233-6299).

These may include:
 Prescribed Grazing
 Residue Management, Mulch Till
 Conservation Crop Rotation
 Cover and Green Manure
 Critical Area Planting
 Stripcropping, Contour
 Stripcropping, Field
 Filter Strips

IDEM Project Manager:
 Project ARN:
 Landowner Initials:
 Date practices completed:

| Example | |
|-------------|-----------------|
| Howard SWCD | WWS |
| 205j | 95-992 |
| Little Deer | HJK |
| | 8/8/1999 |

Please check which BMPs apply:

- Agricultural Field Practices
- Filter Strips

| | Before Treatment | After Treatment | Example Before Treatment | Example After Treatment |
|--|------------------|-----------------|--------------------------|-------------------------|
| RUSLE | | | | |
| Rainfall-Runoff Erosivity Factor (R) | 145 | 145 | 120 | 120 |
| Soil Erodibility Factor (K) | 0.49 | 0.49 | 0.35 | 0.35 |
| Length-Slope Factor (LS) | 0.17 | 0.17 | 0.44 | 0.44 |
| Cover Management Factor (C) | 0.3 | 0.24 | 0.7 | 0.5 |
| Support Practice Factor (P) | 1 | 1 | 0.775 | 0.11 |
| Predicted Avg Annual Soil Loss (ton/acre/year) | 3.62 | 2.90 | 10.03 | 1.02 |

| | Example |
|---------------------------|-----------|
| Contributing Area (acres) | 14 |

The portion of the treated field which contributes eroded soil to the waterbody. The contributing area is defined by the runoff flowpath and by topography and may differ in size from the actual treated field.

Please select a gross soil texture:

- c Clay (clay, clay loam, and silt clay)
- c Silt (silt, silty clay loam, loam, and silt loam)
- c Sand (sand, sandy clay, sandy clay loam, sandy loam, and loamy sand)
- c Peat

Estimated Load Reductions for Agricultural Field Practices

| | Treated | Example |
|-------------------------------------|---------|------------|
| Sediment Load Reduction (ton/year) | 861 | 85 |
| Phosphorus Load Reduction (lb/year) | 1080 | 100 |
| Nitrogen Load Reduction (lb/yr) | 2159 | 200 |

Estimated Additional Load Reductions through Filter Strips

| | Filter Strips | Example |
|-------------------------------------|---------------|------------|
| Sediment Load Reduction (ton/year) | 2240 | 92 |
| Phosphorus Load Reduction (lb/year) | 4148 | 114 |
| Nitrogen Load Reduction (lb/yr) | 7730 | 227 |

Total Estimated Load Reductions

| | Total | Example |
|-------------------------------------|-------|------------|
| Sediment Load Reduction (ton/year) | 3101 | 92 |
| Phosphorus Load Reduction (lb/year) | 5228 | 114 |
| Nitrogen Load Reduction (lb/yr) | 9889 | 227 |

Bank Stabilization

Please fill in the gray areas below. If estimating for just one bank, put "0" in areas for Bank #2.
Once you have successfully estimated the sediment and nutrient load reductions, please print two (2) copies of this worksheet. Attach both copies to the 319A or 319U cost-share form.

If you have any questions, please contact Wes Stone (317/233-6299).

| | Example |
|---------------------------|----------|
| IDEM Project Manager: | WWS |
| Project ARN: | 95-992 |
| Landowner Initials: | HJK |
| Date practices completed: | 8/8/1999 |

Please select a soil textural class:

| | |
|---|--|
| <input type="radio"/> c Sands, loamy sands | <input checked="" type="radio"/> c Silty clay loam, silty clay |
| <input type="radio"/> c Sandy loam | <input type="radio"/> c Clay loam |
| <input type="radio"/> c Fine sandy loam | <input type="radio"/> c Clay |
| <input type="radio"/> c Loams, sandy clay loams, sandy clay | <input type="radio"/> c Organic |
| <input type="radio"/> c Silt loam | |

| Parameter | Bank #1 | Bank #2 | Example |
|---------------------------------|-----------|---------|---------|
| Length (ft) | 100 | 0 | 500 |
| Height (ft) | 10 | 0 | 15 |
| Lateral Recession Rate (ft/yr)* | 0.2 | 0 | 0.5 |
| Soil P Conc (lb/lb soil)** | DEFAULT ▾ | 0.0005 | 0.0005 |
| Soil N Conc (lb/lb soil)** | DEFAULT ▾ | 0.001 | 0.001 |

** indicates default values for P and N soil concentrations

*Lateral Recession Rate (LRR) is the rate at which bank deterioration has taken place and is measured in feet per year. This rate may not be easily determined by direct measurement. Therefore best professional judgement may be required to estimate the LRR. Please refer to the narrative descriptions in Table 1.

Table 1

| LRR (ft/yr) | Category | Description |
|-------------|-------------|--|
| 0.01 - 0.05 | Slight | Some bare bank but active erosion not readily apparent. Some rills but no vegetative |
| 0.06 - 0.2 | Moderate | Bank is predominantly bare with some rills and vegetative overhang. |
| 0.3 - 0.5 | Severe | Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped. |
| 0.5+ | Very Severe | Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-shaped and streamcourse or gully may be meandering. |

Source: Steffen, L.J. 1982. Channel Erosion (personal communication), as printed in "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual," June 1999 Revision; Michigan Department of Environmental Quality - Surface Water Quality Division - Nonpoint Source Unit. EQP 5841 (6/99).

Estimated Load Reductions

| | Bank #1 | Bank #2 | Example |
|-------------------------------------|---------|---------|---------|
| Sediment Load Reduction (ton/year) | 8 | 1 | 150 |
| Phosphorus Load Reduction (lb/year) | 8 | 1 | 150 |
| Nitroaen Load Reduction (lb/yr) | 16 | 1 | 300 |

Appendix I. Contributors' Page

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Michelle Arvin, Vice Chairman
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Distribution of the Little Deer Headwaters WMP
Indiana Department of Environmental Management Watershed Management Section
Howard County SWCD
Howard County Health Department
Indiana-American Water Company, Kokomo, Indiana
Howard County Extension Office
Howard County Plan Commission
Howard County Surveyor's Office
Kokomo-Howard County Library